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Abstract

The background of this study is the realization that our current understanding of innovation in SMEs is relatively poor, yet the encouragement of innovation in SMEs is at the heart of policy initiatives for stimulating economic development at the local, regional, national and European levels. The sample used for this analysis is drawn from a survey that questioned Dutch SMEs about their involvement in three Eastern Netherlands knowledge clusters that were part of a national economic priorities stimulation programme. SMEs that were located in the more rural sub-region Zwolle, namely, indicated that they were not able to profit enough from the programme. The paper explores if the innovation perception of the SMEs in this sub-region is affected by its collaborative knowledge sources in terms of different types of partners, and if structure of the networks may explain the lack of involvement of these SMEs in the programme. Also, it aims to explore if the internal power relationships of an SME – represented in this study by the education level of the owner/ manager of the SME – influences these relationships. Powerful actors within and outside the organization, namely, may influence the knowledge absorption processes. Results support the strong focus of SMEs on customers and suppliers for new knowledge and the positive role of higher education on the innovation process. In this study, no significant proof is found for the interaction of higher educated entrepreneurs on the relation between knowledge sources and innovation perception. Preliminary insight into the positive and negative interaction effect of the education level of the entrepreneur on the relation between knowledge sources and innovation perception, however, may provide interesting new research directions.

Key words: innovation process, absorptive capacity, SMEs, moderated hierarchical regression

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1. Introduction

All recent regional innovation theories, such as industrial districts and clusters (Becattini, 1990; Pyke, et al., 1990; Cappellin, 1998; Brenner, 2004), 'innovative milieux' (Capello, 1999; Crevoisier and Camagni, 2000;) Capello and Faggian, 2005), regional innovation systems (Cooke, 1998; Cooke and Morgan , 1998), the dynamics of proximity (Bellet et al, 1993; Rallet and Torre, 1998; Filippi and Torre, 2003; Torre and Gallaud, 2004; Boschma, 2005; Torre and Rallet, 2005; Torre, 2008) and the learning regions (Florida, 1995; Morgan, 1997; Maillat and Kebir, 1999, van Geenhuizen and Nijkamp, 2006) stress the increasing importance of a network approach and closely related elements, such as territorial embeddedness, interactive learning and absorptive capacity and institutional thickness. According to Edwards et al. (2005) despite the voluminous literature on innovation in small and medium sized enterprises (SMEs) however, the aggregate benefits have been marginal in explaining the innovation process in SMEs. In particular, there is a hiatus between what is understood by way of general innovation literature and the existing literature on innovation in SMEs. Studies of innovation in SMEs have, for long, failed to reflect advances in the innovation literature. This is surprising, because the encouragement of innovation in SMEs lies at the heart of policy initiatives for stimulating economic development at the local, regional, national and European levels (Jones and Tilley, 2003). This is a policy direction that is inspired by the logic of entrepreneurship in stimulating economic growth (Hutton, 1995). Increasingly, serious academic attempts are initiated to overcome this hiatus (Cappellin and Wink, 2009) but our current understanding of innovation in SMEs is still relatively poor. In particular, the relationship between firm-level practice and the external environment represents an important focus of research that has remained largely underdeveloped in the existing literature of innovation in SMEs.

For long, the literature has been dominated by studies that aim to predict success by identifying the determinants of innovation. Edwards et al. (2005), in this respect, point to those studies that try to indentify the critical success factors for innovative strategy in SMEs (Riedle, 1989; Dodgson and Rothwell, 1991; Bowen and Rickets, 1992), and those that specify successful technology and innovation practice in SMEs (Rinholm and Boag, 1987; Bracker et al., 1988; Boag and Rinholm, 1989; Carland et al., 1989; Radosevic, 1990; Oakey and Cooper, 1991,

Berry, 1996). Due to increasing complexity of new technologies and continuing developments in information and communication technology, firms of all sizes are much less likely to innovate by themselves (Powell et al., 1996). Firms are now working with academic institutions and other firms through innovation networks in and between sectors, regions and nation-states (Coombs et al., 1996; Hakansson, 1989; Hagedoorn and Schakenraad, 1992; Soeters, 1993). Increasingly, researchers, and also policy makers, seem to acknowledge that the innovation process is now increasingly distributed across multiple actors, and that the connections between firm-level activities and the wider processes connected with such networks is significant (Coombs and Harvey, 2001).

Innovation is a social process where the strategic choices of agents are not simply an outcome of economic transactions but involve reconciling both the exercise of control and knowledge communication (Scarbrough, 1995). Thorough analysis of the relationship between the practices of agents and the nature of how these agents and their firms are embedded within their institutional context remains scarce. Making sense of the mutual interdependence between the firm and social processes is essential to understand the necessary individual skills and competences of the innovative entrepreneur. Investigation of the material and cognitive resources of the immediate environment of SMEs (see Preti, 1991), for example, reveals that SMEs' practices are mediated through their environment in often complex and contradictory ways (Delmestri, 1997). Given such complexity, joint understanding of 'the individual entrepreneur, her or his venture, and the context' is essential for understanding innovation in SMEs (Edwards et al., 2005; Johannisson and Monsted, 1997).

Aim of this paper is to add to this understanding by means of an exploration of the innovation perception of SMEs and if this perception is influenced by its collaborative knowledge sources in terms of different types of partners. The cluster collaboration in the Eastern Netherlands may serve as an interesting case study in this respect, because it specifically focuses on innovation behaviour in a more rural area of the Netherlands and, as a result, on a more specific sub-set of SMEs that appear to have less easy access to new knowledge. Such a focus point may help to determine if there are differences in knowledge sources between SMEs in more urban and more rural regions, and what if the education level of the owner/manager of the SME may affect these knowledge collaborations. This may prove further insight into the seeming inability of the Dutch government programme to reach the SMEs in the Eastern

Netherland Zwolle region. Our moderated hierarchical regression approach will be based on the data of questionnaire that was designed to explore the bottlenecks and opinions of entrepreneurs (2493 in total) in that particular area (Masurel & Werkhoven, 2006).

To answers our research question, first there is an overview of the literature on the working of a firm's innovation process and the role of absorptive capacity therein. Secondly, the theoretical model on which the analysis in this paper is based is introduced, as well as the sample used for our moderated hierarchical regression. Thirdly, the results and the discussion of the results are outlined. Finally, the main conclusions are presented.

2. The innovation process in SMEs

In this paper we use the definition of innovative SMEs suggested by Edwards et al. (2005) as being those SMEs that identify, interpret and apply knowledge effectively and appropriate throughout the organization. Innovation, in this respect, is the total of constraining and enabling aspects of existing competencies, dispositions, resources and firm's structures that include the strategic orientation and the core practices and techniques of managers. Attention lies in particular on the 'process' of innovation rather than on critical factors or practices for successful innovation in order to better understand how the links between firm and the environment reveal both pro-active and re-active moments. This innovation process consists of several episodes including an invention, diffusion, appropriation and implementation stage, which are generally recursive rather than sequentially organized. In Figure 1 the different recursive steps are presented in a model. Invention is a personalized process where individuals form relations based on expertise and skills for the purpose of translating ideas into concepts and models (Nonaka, 1991). Building such understanding and trust among individuals and groups relies on networking across the organization. Diffusion involves boundary-spanners negotiating the exchange of 'know-how' between the designers and users of such 'knowledge solutions'. Professional bodies play a key role in legitimating the diffusion of new technologies. Appropriation or assimilation of new technologies, in turn, will involve a 'community' approach to embed the technology within the organization (Newell et al., 2002). Finally, implementation is an occasion when such practices can be transformed and new interpretations and physical manifestations can emerge.

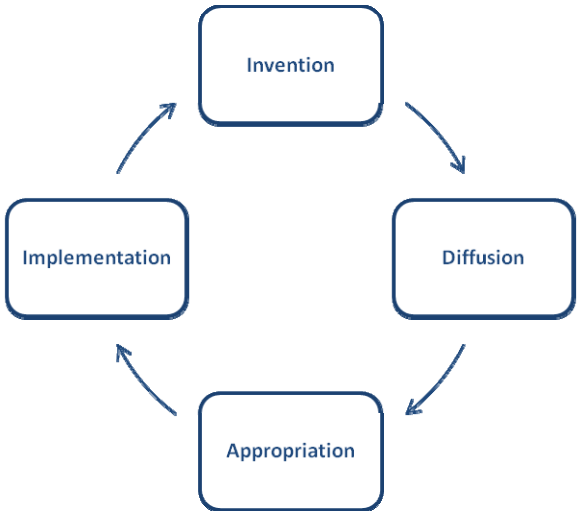

Figure 1 Representation of the recursive innovation process

At each episode, individuals are involved in giving meaning and the physical character of the technology within existing organizational and institutional structures. This is apparent not only in technical innovation but also the creation and adoption of new services and practices. Scarbrough (1995) refers to this as knowledge communication. This process includes mediation by the 'social network' that informs whether a new idea is viable (Drazin and Schoonhoven, 1996). This social network also represents a complex pattern of institutions, which mediates the development of the 'coordinating, learning and reconfigurational capabilities' of the firm (Whitley, 2003). Such a complex social pattern can also result in strong ties that restrict organizations from adapting to radical technological and market change (Uzzi, 1997). Improving our understanding of innovation in SMEs according to Edwards et al. (2005) focuses in particular on the connection of these strategic choices of managers with the mediating pressures of the firm's immediate and wider institutional context. Innovation researchers are slowly picking up on this need. Although initially research focused on the motives behind R&D collaboration (Fritsch and Lukas, 2001; Tether, 2002; Miotti and Sachwald, 2003; Belderbos et al., 2004a), increasingly authors are also evaluating the impact of different types of collaborative networks on product performance (Lööf and Heshmati, 2002; Criscuolo and Haskel, 2003; Miotti and Sachwald, 2003; Belderbos et al., 2004; Faems et al., 2005; Nieto and Santamaria, 2007).

Outcomes of these studies show inconsistent results and thereby underline the complexity of how individuals and firms relate to each other and other institutional bodies and how this affects the innovation performance of firms. The studies also support the assumption that the individual entrepreneur, the firm and the context need to be considered jointly.

To complicate matters further. In a recent study, Tsai (2009) suggests that these ambiguous research outcomes imply that the relationship between collaborative networks and product innovation performance in turn is moderated again by other contextual factors. In his study Tsai in particular refers to the presence of a sufficient degree of absorptive capacity that is considered necessary to improve effective knowledge communication in a collaborative agreement between firms or other institutional actors (Mowery et al., 1996; Lane et al., 2001). Absorptive capacity, in this respect, refers to a firm's ability to use its own prior related knowledge to recognize, assimilate, and use external knowledge for its own commercial ends (Cohen and Levinthal, 1990). Zahra and George (2002) and Todorova and Durisin (2007) further characterize absorptive capacity as a bundle of five capabilities: recognition, acquisition, assimilation, transformation, and exploitation. The degree of absorptive capacity that these five capabilities represent, are considered to determine for a large part the success of the innovation process as depicted in Figure 1. In Figure 2, a model representation is given of the interaction between the four episodes of the innovation process and the five capabilities that represent absorptive capacity. In this study we focus in particular on the diffusion and appropriation episodes of which it is already argued by numerous studies that a certain degree of absorptive capacity is required for effective learning in inter-organizational collaboration (e.g., Mowery et al., 1996; Kim, 1998; Lane and Lubatkin, 1998; Lane et al., 2001).

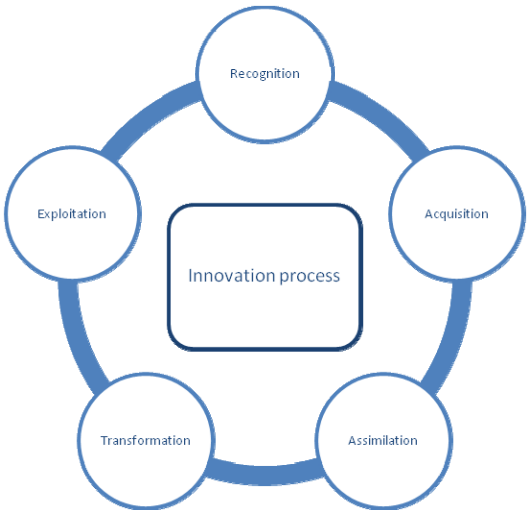

Figure 2 Extended model representation of the interaction between innovation process and absorptive capacity

3. The analysis of absorptive capacity

The absorptive capacity of a firm is considered to depend greatly on its existing technological knowledge base (Cohen and Levinthal, 1990; Kim, 1997, 2001). Prior research therefore views in-house R&D investment as the key determinant of a firm's absorptive capacity (e.g., Cohen and Levinthal, 1990; Mowery et al, 1996; Carayannis and Alexande, 2002; Todorova and Durisin, 2007). However, a reason why SMEs generally show weaker performance in R&D is because they often lack necessary resources to follow such strategic decisions in knowledge creation processes. In contrast, the development of personal skills has always been a major strategic aspect, as the availability of specific skills builds a competitive advantage in particular over bigger firms. Skill development, for long, was integrated into daily production practices to build up routines and firm-specific embedded knowledge (Bougrain and Haudeville, 2002). This is also known as tacit knowledge (Nonaka, 1991, 1994). A recent study by Cappellin and Wink (2009) however, shows that those SMEs that are able to change their strategies towards new and diversified markets or intensify their strength in niche markets, are characterized by higher rates of external further education than other SMEs. Cappellin and Wink (2009) suggest that new structural requirements require skills that help to create linkages

between the SMEs and suitable partners or between incumbent markets and new strategic sales market options. Consequently, they argue that the importance of further education, or explicit knowledge not only inside the SME but also within external modules increases. On this basis, it can be assumed that for SMEs further education will increase recognition, acquisition, assimilation, transformation, and exploitation of new knowledge, i.e. absorptive capacity.

This paper focuses, in particular, on 'recognizing the value' component of absorptive capacity (Todorova and Durisin, 2007). Cohen and Levinthal (1990) propose recognizing the value as the first component of absorptive capacity based on evidence that without prior knowledge, organizations are not able to evaluate the new information and, thus, fail to absorb it. Nonaka (1991, 1994) further specifies that knowledge for the management of innovation is created out of a dialogue between peoples' tacit and explicit knowledge. Knowledge may, in this respect, move from tacit to tacit (e.g., in a craft apprenticeship), from explicit to explicit (e.g., when hitherto distinct but related bodies of information are brought together), from tacit to explicit (e.g., the study of craft skills), and from explicit to tacit (e.g., the internalization of new knowledge). Less innovative firms, it is argued, often fail to identify and absorb valuable new external knowledge because they are hampered by their embedded knowledge base, rigid capabilities, and path-dependent managerial cognition (Gavetti and Levinthal, 2000; Helfat, 2000; Langlois and Steinmuller, 2000; Leonard-Barton, 1992; Tripsas and Gavetti, 2000). The valuing of new external knowledge is thus not automatic, but is biased and needs to be fostered to allow the absorption to begin at all. According to the models of Cohen and Levinthal (1990) and Todorova and Durisin (2007), a firm, first of all, needs prior knowledge and a knowledge source for the process of innovation to 'begin' with recognition of the value of new knowledge. Further, at this point, also powerful actors within and outside the organization may influence knowledge absorption processes to achieve their goals. Todorova and Durisin (2007), in their model, propose that this power relationship construct consists of both the power relationships inside the organization and the power relationships with customers and other external stakeholders. Activation triggers are internal or external events (for example, an organizational crisis or external innovation subsidy programme) that encourage or compel a firm to seek external knowledge (Zahra and George, 2002). Regimes of appropriability, lastly, are less clearly defined but moderate the relationship between absorptive capacity and its outcome of sustainable

competitive advantage. They are argued to be less direct external influences like a market characterized by low efficacy of intellectual property rights.

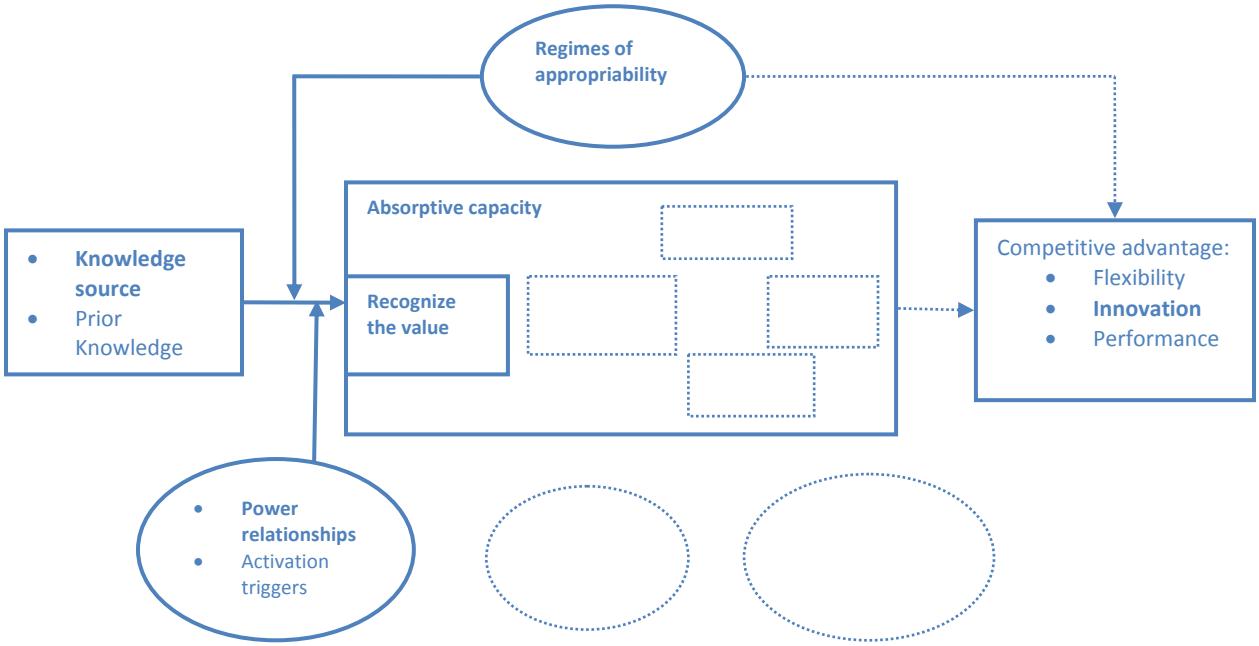

Figure 3 A cut out of the refined model of absorptive capacity (Todorova and Durisin, 2007)

4. Research method

The sample used for this analysis is drawn from a survey that questioned Dutch SMEs about their involvement in three Eastern Netherlands knowledge clusters that were part of a national economic priorities stimulation programme (Masurel and Werkhoven, 2006). One of the main aims of the programme was to improve interaction between the three local universities and local industry. However, in particular, SMEs that were located in the more rural sub-region Zwolle indicated that they were not able to profit enough from the programme, even though the promotion of regional economic development was one of the economic priorities of the programme (Ministry of Economic Affairs, 2004). According to Cappellin and Wink (2009), the structure of any network generally can be classified into six groups: large industrial firms, industrial SMEs, knowledge intensive business services, financial services, research institutions and public institutions. Further, they state that these networks may be more efficient in some regions than in others. Aim of this paper is to explore if the innovation perception of the SMEs in

this sub-region is affected by its collaborative knowledge sources in terms of different types of partners, and if structure of the networks may explain the lack of involvement of these SMEs in the programme.

Also, this paper aims to find if, in particular, the *internal* power relationships of an SME influences these relationships (see Figure 4). In this study, it is argued that the owner/ manager of the SME dominates the power structures in the organization. Earlier, it was suggested that further education will increase recognition, acquisition, assimilation, transformation, and exploitation of new knowledge. Therefore, we assume that owners/mangers with a higher education will further enable recognition of new knowledge through their networks. Finally, as in the of Todorova and Durisin (2007) model, we suggest that there are less direct (external) influences that moderate the relationship between value recognition and its outcome of innovation perception. In this study, however, these influences act as controls in the model to eliminate or reduce the bias arising from the confounding effects. Since the focus of this paper is primarily on the relation between knowledge sources and the ability to recognize value, the controls used are mainly (internal) organizational influences.

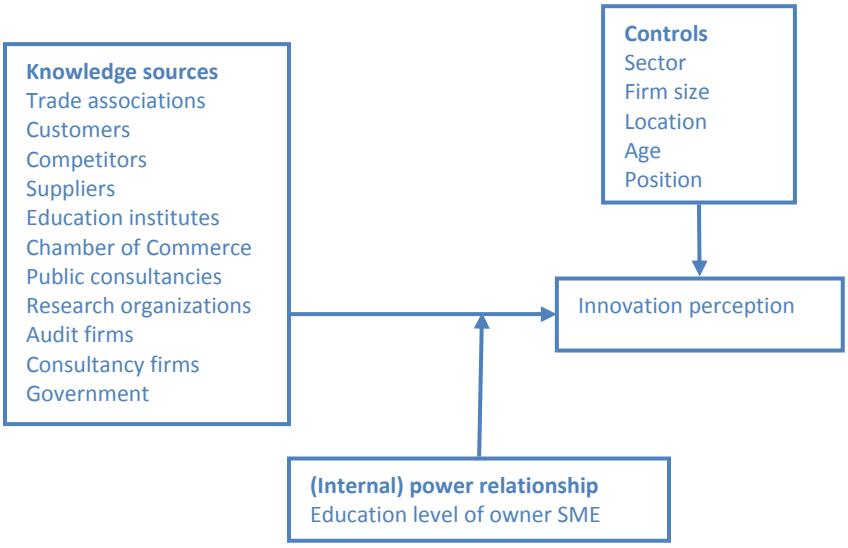

Figure 4 Conceptual framework

Insight into the knowledge sources is particularly interesting for understanding the innovation process of SMEs, because SMEs are generally considered to innovate with higher resource intensity than large firms, especially regarding human resources (Kaufmann and Tödtling, 2002). Also, SMEs are less often engaged in research than large firms. Further, SMEs are less able to shape and influence the external environment than large firms (Smallbone et al., 2000). Studies have found in this respect that customers, in particular, play an important role in guiding the innovation activities of SMEs (von Hippel, 1988). Other studies support the strong relation of SMEs with customers by stating that the innovation relationships of SMEs are predominantly within the business sector with customers and suppliers being most important, less service firms and horizontal relations (e.g., Fritsch and Lukas, 1997; Sternberg, 1998; Kaufmann and Tödtling, 2000). According to these studies, SMEs are rarely interacting with universities, contract research organizations, technology centres, and training institutions (Cooke et al., 2000; OECD, 2009). Also, findings show that the extent of R&D collaboration seems positively correlated with firm size, whatever the sector (Miotti and Sachwald, 2003; Laursen and Salter, 2004; Dhont-Peltrault, 2005; Herstad et al., 2008). Further, with regard to university-industry knowledge exchange, research shows that universities are used to source knowledge to innovate by a relatively small number of companies operating mainly in certain industrial sectors (pharmaceuticals, chemicals, machinery, transportation, and electric and electronic equipment (Laursen & Salter, 2004).

5. Survey sample

The survey that this analysis is based on was set up to provide empirical evidence on the potential of the SME sector in the region of Zwolle and surroundings to keep up with the developments in the knowledge clusters centred around the cities of Wageningen, Nijmegen en Enschede. Around these three Eastern Netherlands cities there is a large concentration of public and private knowledge-intensive activities, which can for a large part be linked to the universities in these cities (Ministry of Economic Affairs, 2004). The remaining part of the region has a strong presence of manufacturing-related industry. In our sample, also the majority of firms are active in the manufacturing sector, followed by construction and services (Table 1). Also, a relatively large part of the SMEs indicated that they belonged to another sector. Overall, firms in this sector were active in tourism or agriculture. Further, a majority of 185 SMEs from our

sample are considered small (between 0-50 employees), while 57 firms are medium sized (between 50-250 employees). Further, a majority of 97 owners/ managers are educated at the university of applied sciences (Dutch HBO), followed by 61 owners/ managers have a degree in vocational education and training (Dutch MBO), 44 owners/ managers finished some form of high school, and 35 owners/ managers have a university education. Finally, 3 owners/ managers have only finished primary school.

Table 1 Sample divided by sector (N=242)

Sector	**N**	**%**
Manufacturing	60	20.6
Construction	59	20.3
Wholesale	20	6.9
Transport	16	5.5
Services	44	15.1
Other	43	14.8

The independent variable in this study is the innovation perception of the SMEs of our sample. In the survey, SMEs were asked how innovative they considered their firms to be. A majority of 157 SMEs regarded their firm as reasonable innovative, 42 SME were hardly innovative and 6 not at all. Only 37 SMEs considered their firms very innovative (see Table 2). The results indicate that the SMEs in the sample do not generally overestimate their innovative performance, although there is likely to be a large variation in the actual performance of SMEs in our sample that consider themselves reasonably innovative. For this reason, this paper uses the term innovation perception instead of innovation performance for this variable.

Table 2 Independent variable: innovation perception (N=242)

Q: How innovative do you consider your firm to be?	**N**	**%**
Very	37	2.1
Reasonably	157	14.4
Hardly	42	53.8
Not	6	12.7

The dependent variables in this study are the knowledge sources that the SMEs in our sample use for innovation activities. This variable is based on a question that asked the SMEs of our sample via which organization their company acquires knowledge to innovate. Multiple answers were possible. Table 3 shows that a majority of 151 SMEs use trade associations as knowledge source, followed by suppliers and customers, and to a lesser but still considerable extent competitors. Only 8 SMEs go to Chambers of Commerce for knowledge to innovate and also the government scores relatively low as a knowledge source for these SMEs. Surprisingly, or not, education institutes like universities or universities of professional education as well as research organizations also score relatively low in this region. This could be an indication that there is indeed a relation between the use of knowledge sources and the innovation level in a region, which is in this particular analysis more rural (according to Dutch standards).

Table 3 Dependent variable: knowledge sources (N=242)

Q: Via which organization does your company acquire knowledge to innovate?	**N**
Trade associations (TA)	151
Customers (CT)	128
Competitors (CP)	108
Suppliers (SP)	139
Education institutes (EI)	32
Chamber of Commerce (CC)	8
Public consultancies (PC)	30
Research organizations (RO)	23
Audit firms (AF)	19
Consultancy firms (CF)	41
Government (GV)	10

Table 4 reports the basic statistics for the variables used in this analysis. We see here that a certain proportion of the firms within the sample collaborate with more than one type of partner for knowledge acquisition, according to the significance of the correlation coefficients at the 5% significance level of the majority of the knowledge variables. In particular, SMEs that have the government (GV) as knowledge source also exchange knowledge with consultancy firms (CF) ($r = 0.18$, $p < 0.01$), while SMEs that exchange knowledge with trade associations (TA) also do so with their customers (CT) ($r = 0.16$, $p < 0.01$). Further, chamber of commerce

(CC) as a knowledge source has the lowest value in its mean and standard deviations among the knowledge variables. This indicates that collaboration with the chamber of commerce is the least common type of partnership for innovation (perception). This is in line with our findings in Table 3. Lastly, a significant correlation exists between sector (S) and innovation perception (IP). This finding suggests that the type of sector influences the innovation perception of SMEs.

Table 4 Mean, standard deviation and correlations (N=242)

Var	IP	H	L	S	E	A	P	HE	TA	CT	CP	SP	EI	CC	PC	RO	AF	CF	GV
IP	1,000																		
H	0.047	1,000																	
L	-0.010	-0.200[a]	1,000																
S	0.212[b]	0.008	-0.108[b]	1,000															
E	0.024	0.346[a]	-0.049	-0.085[c]	1,000														
A	-0.003	0.034	-0.024	-0.136[b]	0.192[a]	1,000													
P	0.052	-0.241[a]	0.033	0.057	-0.113[b]	-0.112[b]	1,000												
HE	0.196[a]	0.099[c]	-0.038	-0.003	0.168[a]	-0.106[c]	0.037	1,000											
TA	-0.124	-0.088[c]	0.038	0.087[c]	0.062	0.045	0.030	-0.176[a]	1,000										
CT	0.217[a]	0.063	-0.082	-0.064	0.135[b]	-0.042	0.049	0.253[a]	-0.169[a]	1,000									
CP	0.059	0.101[c]	0.027	0.004	0.053	0.001	0.069	0.082	-0.110[b]	0.164[a]	1,000								
SP	0.152[a]	0.068	0.145[b]	-0.146[b]	0.155[a]	0.030	-0.058	0.086[c]	0.005	0.058	0.100[c]	1,000							
EI	0.118[b]	-0.026	-0.015	0.089[c]	0.108[b]	0.030	0.110[b]	0.089[c]	0.026	0.100[c]	0.018	-0.034[a]	1,000						
CC	0.056	0.001	0.043	0.088[c]	-0.015	0.140[b]	-0.101[c]	-0.069	0.048	-0.057	0.020	0.159	0.133[b]	1,000					
PC	0.099[c]	-0.100[c]	-0.002	0.135[b]	0.012	0.087[c]	-0.081	-0.090[c]	0.085[c]	-0.022	-0.136[b]	-0.006	0.112[b]	0.211[a]	1,000				
RO	0.057	0.140[b]	-0.143[b]	-0.008	0.129[b]	0.141[b]	-0.127[b]	0.130[b]	-0.068	-0.005	0.049	0.051	0.081	0.019	0.049	1,000			
AF	-0.087[c]	-0.061	-0.042	0.047	-0.117[b]	-0.087[c]	0.026	-0.078	0.131[b]	-0.032	-0.015	-0.028	-0.023	0.204[a]	-0.017	-0.095[c]	1,000		
CF	0.049	0.098[c]	0.015	-0.024	0.140[b]	0.068	-0.098[c]	0.098[c]	0.009	0.095[c]	0.082	0.188[a]	0.116[b]	0.163[a]	0.064	0.117[b]	0.114[b]	1,000	
GV	0.119[b]	0.073	0.036	0.107[b]	-0.049	0.061	-0.045	0.105[c]	0.033	0.071	0.064	-0.031	0.103[c]	0.310[a]	0.048	0.145[b]	0.094[c]	0.183[a]	1,000
Mean	2.93	0.2479	7734.83	3.2231	42.58	45.0909	2.33	6.1405	0.6240	0.5289	0.4463	0.5744	0.1322	0.0331	0.1240	0.0950	0.0785	0.1694	0.0413
S.D.	0.650	0.43271	676.257	1.89556	46.284	9.30712	1.057	1.7082	0.4854	0.5002	0.4981	0.4955	0.3394	0.1792	0.3302	0.2939	0.2695	0.3759	0.1995

Notes: (1) IP: innovation perception; H: holding membership; L: location; S: sector; E: number of employees; A: age of the owner, manager; P: position in SME; HE: education level of entrepreneur (absorptive capacity); TA: trade associations as knowledge source; CT: customers as knowledge source; CP: competitors as knowledge source; SP: suppliers
as knowledge source; EI: education institutes as knowledge source; CC: chamber of commerce as knowledge source; PC: public consultancies as knowledge source; RO: research organizations as knowledge source; AF: audit firms as knowledge source; CF: consultancy firm as knowledge source; GV: government as knowledge source.

[a] p<0.01

[b] p<0.05

[c] p<0.10

5. Analysis

OLS-based hierarchical regression is used to estimate the models in this study. Model 1 contains several control variables, including holding membership dummy (H), location (L), sector (S), number of employees or firm size (E), age of the owner of the SME (A), and position of the respondent in the SME (P) divided by owner or manager. In model 2 absorptive capacity (HE) and the knowledge source variables (CT, CP, SP and EI) are added. In model 3 finally the terms of interaction between the knowledge source variables and the HE variable are entered. The interaction terms are usually highly correlated with the HE or the knowledge variables. This study follows the procedure suggested by Friedrich (1982) to reduce or eliminate any bias resulting from multi-collinearity. This approach first standardizes the variables except for the control variables and then forms the cross-product terms.

Table 5 presents the moderated regression analysis results for the model. The results indicates that adding the knowledge source and higher education variables (Model 2) to the model with only the controls (Model 1) decreases the R^2 by about 6%. The F-value (2.74) for the incremental R^2, however, achieves a statistical significance at the 1% level. The coefficient estimates of the knowledge source variables indicate that customers as a knowledge source and suppliers as a knowledge source significantly explain change in the innovation perception when the model does not account for the effect of internal power relationships. Adding the interaction term (Model 3) to Model 2 increases the R^2 slightly again by about 2.5%. The F-value (0.62) for the incremental R^2 value, however, does not achieve statistical significance which indicates that the interaction terms of both the knowledge variables and the power relationship variable do not have explanatory powers with regards to the change in the SMEs' innovation perception. The variance inflation factors (VIF) for all the coefficient estimates in Model 3 are below 10, indicating that multi-collinearity does not contaminate the results as suggested by Mason and Perreault (1991). Model 3 may be considered a weaker model on the basis of the F-values. In weaker models VIF values over 3 may be a cause for concern. In Model 3, the interaction between education level and government as a knowledge source can in this respect be considered near perfect linear combinations of one another, which is considered to lead to multicollinearity and instability of the b and beta coefficients of these variables.

Table 5 Results of moderated hierarchical regression analysis (N=242)

Variable	Model 1		Model 2		Model 3		VIF
H	0.057		0.038		0.038		1.364
L	0.014		0.003		0.000		1.261
S	0.122	*	0.134	**	0.116	*	1.170
E	0.019		-0.049		-0.057		1.378
A	0.015		0.027		0.038		1.265
P	0.062		0.056		0.058		1.181
HE			0.122	*	0.132		1.654
TA			-0.087		-0.092		1.170
CT			0.164	**	0.183	***	1.196
CP			-0.003		-0.008		1.146
SP			0.165	**	0.176	**	1.207
EI			0.066		0.081		1.233
CC			0.003		0.059		1.626
PC			0.098		0.070		1.240
RO			0.008		0.016		1.440
AF			-0.066		-0.090		1.273
CF			-0.021		0.004		1.227
GV			0.080		0.001		3.546
HE*TA					0.002		1.201
HE*CT					-0.056		1.315
HE*CP					-0.020		1.294
HE*SP					0.048		1.290
HE*EI					0.015		1.275
HE*CC					0.098		1.492
HE*PC					-0.091		1.280
HE*RO					-0.033		1.454
HE*AF					-0.072		1.230
HE*CF					-0.085		1.173
HE*GV					0.075		3.321
R^2	0.21		0.147		0.173		
Adj-R^2	-0.004		0.078		0.060		
F-value	0.835		2.132	***	1.532	**	
ΔR^2			0.126		0.026		
F-value for ΔR^2			2.744	***	0.615		

Standard errors are in parentheses.
*** p<0.01
** p<0.05
* p<0.10

The F-value (1.53) of the R^2 further achieves a statistical significance at the 5% level instead of the 1% level, and shows no significant interaction between the choice for knowledge sources and the education level of the owner/ manager of the SME. Although model 2 indicates

that the education level of the owner/ manager of the SME has a significant positive impact on innovation perception (β = 0.122, p < 0.10), Model 3 indicates no interaction effect of the education level on the relation between the knowledge sources and the innovation perception of the SME in the eastern Netherlands Zwolle region. The significant positive relations between the sector where the SME is active (β = 0.134, p < 0.05), customers as a knowledge source (β = 0.164, p < 0.05), suppliers as a knowledge source (β = 0.165, p < 0.05), and innovation perception in Model 2, however, remain intact in Model 3. So, the analysis finds support for the assumption that the innovation perception of SMEs in the Zwolle region is affected by its collaborative knowledge sources in terms of different types of partners. No significant support is found for the assumption that owners/ managers with a higher education will further enable recognition of new knowledge through their networks, however, although the education level of the owner/ manager of the SME does have a significant influence on the innovation perception. Finally, the analysis finds support for the influence of the sector that the SME is active in on the innovation perception, which supports the idea that there are less direct organizational factors that influence the innovation perception of an SME.

6. Discussion

The results of our analysis largely support the previous literature that highlight the strong relationship of firms with customers and suppliers for innovation (e.g., Fritsch and Lukas, 1997; Sternberg, 1998; Kaufmann and Todtling, 2000; OECD, 2009). Our study shows that these relationships significantly influence the innovation perception of SMEs in the Eastern Netherlands Zwolle region. Our results also underline the effect of sector specialization of an SME on innovation perception. Also, our analysis underlines the insignificant relation that SMEs have with universities and research organizations for innovation purposes (Cooke et al., 2000; OECD, 2009). Although the relation between the education level of the owner/ manager of the SME and the innovation perception is significant in our analysis, there is no support found for the assumption that owners/ managers with a higher education will further enable recognition of new knowledge through their networks. As a result, we do not find that this particular internal power relationship of an SME influences the relationship between knowledge sources and recognition of the value of new knowledge, represented by innovation perception. Maybe a

larger sample size will give better results. Also, measures for internal power relationships could be better defined. Todorova and Durisin (2007) refer to the study of Dougherty and Hardy (1996) that use collaboration, resources and strategy as internal power relationships indicators. Further, they also mention the influence of external power relationships with customers for example. This study, however, focuses primarily on the influence of the different knowledge sources that SMEs use and their relation to general innovation perception. Future studies that have a particular innovation project as their object of study may be able to design a more detailed conceptual framework. The education level could in that case also function as prior knowledge. Further activation triggers are considered to influence the innovation process and should also be considered in future models. In particular, the influence of government subsidy programmes on the innovation process is in this respect an interesting trigger for future study.

As mentioned before, the sample used for this analysis is drawn from a survey that questioned Dutch SMEs about their involvement in three Eastern Netherlands knowledge clusters that were part of a national economic priorities stimulation programme (Masurel and Werkhoven, 2006). One of the main aims of the programme was to improve interaction between the three local universities and local industry. However, in particular, SMEs that were located in the more rural sub-region Zwolle indicated that they were not able to profit enough from the programme. Our results support the strong reliance of SMEs in this region on customers and suppliers for new knowledge. Generally, owners/ managers in the region Zwolle are well educated, but lower than in the more urban areas of the Netherlands. According to our results, the education level is positive and significantly influences the innovation perception in the region, but it does not interact with the relation between knowledge source and innovation perception. So, although a higher education level leads to a higher innovation perception, our results do not significantly show if a higher level of education leads to a higher or lower level of cooperation with certain knowledge sources. The collinearity between the variables education level and government as a knowledge source gives an indication of the positive linearity that exists between the two variables, even after standardization. Further analysis of the two variables indeed shows that only the higher educated owners/ managers in our sample use government as a source for new knowledge. Future research studies that have access to larger databases may hopefully be able to provide more significant results in this direction. This may however be an indication that a reason why most SMEs in the Eastern Netherlands Zwolle region did not profit

from the programme, is related to their general lack of contact with the government for knowledge purposes. Future analysis of the knowledge collaboration with higher educated owners/ managers of SMEs and the government should be conducted to provide further proof in this direction.

7. Conclusion

The background of this study is the realization that our current understanding of innovation in SMEs is relatively poor, yet the encouragement of innovation in SMEs is at the heart of policy initiatives for stimulating economic development at the local, regional, national and European levels, which is largely stimulated by the logic of entrepreneurship in stimulating economic growth. However, studies of innovation in SMEs have for long failed to reflect advances in the innovation literature and vice versa. In particular for SMEs, their innovation strategies adopted strongly relate to their existing customer base and institutional structures. Therefore, exploring the innovation process of SMEs requires a strong focus on the mutual interdependence between firms, institutional structures and social processes. In this study we suggested that the model of absorptive capacity can improve understanding of innovation processes and facilitate empirical model building. This paper focused in particular on 'recognizing the value' component of absorptive capacity, which requires a knowledge source besides various other internal and external moderators. The SMEs in the sample used for our analysis indicated that they were not able to profit enough from a government cluster programme that aimed to improve interaction between the three local universities and local industry in order to improve regional competitiveness. Since the SMEs were located in a more rural area of the Netherlands, we were specifically interested in what type of knowledge sources that they used for the acquisition of new knowledge and if interaction existed between these relationships and the education level of the owners/ managers of the SMEs of our sample.

On the basis of the results of our study, innovation behavior in this region nevertheless does not seem exceptionally different from innovation behavior in other regions, where knowledge for innovation is also primarily gained through customers and suppliers. Although the education level of the owner/ manager of the SME is significant and positively related with the innovation perception of the SME, further insight into the role of education on the innovation

and absorptive capacity process is necessary to come to more interpretable results about the interaction effect of the education level of the entrepreneur and its knowledge sources for which no significant results were found in this study. The sample size of this analysis was rather low with 242 ‘useable’ respondents. Also, respondents were not asked about their approach towards a particular innovation project, but about their general experiences regarding the acquisition of knowledge for innovation. Although this provided interesting insights into their knowledge acquisition strengths and bottlenecks, several relations and moderating influences that are proposed in the model of absorptive capacity could therefore not be included in our theoretical framework. The strong support that our model provides for the literature that already exists about innovative SMEs, however, suggests interesting starting-points for future study in this direction.

References

Becattini G (1990) The Marshallian industrial district as a socio-economic notion. In Pyke P, Becattini G, Sengenberger W (eds) *Industrial Districts & Inter-Firm Co-operation in Italy*. International Institute for Labour Studies, Geneva.

Belderbos R, Carree M, Lokshin B (2004) Co-operative R&D and firm performance. *Research Policy 33* (10): 1477-1492.

Belderbos R, Carree M, Diederen B, Lokshin B, Veugelers R. (2004) Heterogeneity in R&D co-operation strategies. *International Journal of Industrial Organization 8* (9): 1237-1263.

Bellet M, Colletis G, Lung Y (1993). Economie de proximites. *Numero Special, Revue d'Economie Regionale et Urbaine 3*.

Berry M (1996) Technical entrepreneurship, strategic awareness, and corporate transformation in small high-tech firms. *Technovation 16* (9): 187-198.

Boag D, Rinholm B (1989) New product management practices of small high technology firms. *Journal of Product Innovation Management, 6* (2): 109-122.

Boschma RA (2005) Proximity and innovation: a critical assessment. *Regional Studies 39* (1): 61-73.

Bougrain F, Haudeville B (2002) Innovation, collaboration and SMEs' internal research capabilities. *Research Policy 31* (5): 735-747.

Bowen A, Rickets M (1992) *Stimulating Innovationin Industry: the Challenges for the United Kingdom.* NEDO, London.

Bracker J, Keats B, Pearson J (1988) Planning and financial performance among small firms in a growth company. *Strategic Management Journal 9* (6): 591-603.

Brenner T (2004) *Industrial Clusters: Existence, Emergence and Evolution.* Routledge, London.

Capello R (1999) Spatial transfer of knowledge in high-technology milieux: learning versus collective learning processes. *Regional Studies, 33* (4): 353-365.

Capello R, Faggian A (2005) Collective learning and relational capital in local innovation processes. *Regional Studies 39* (1): 75-87.

Cappellin R (1998) The transformation of local production systems: international networking and territorial competitiveness. In Steiner M (ed) *From Agglomeration Economies to Innovative Clusters.* Pion, London.

Cappellin R, Wink R (2009) *International Knowledge and Innovation Networks.* Edward Elgar, Cheltenham.

Carayannis E G, Alexander J, (2002) Is technological learning a firm core competence, when, how and why? A longitudinal, multi-industry study of firm technological learning and market performance. *Technovation 22* (5): 625-643.

Carland J W, Carland J A, Aby C (1989) An assessment of the psychological determinants of planning in small business. *International Small Business Journal 7* (1): 23-34.

Cohen W M, Levinthal D A (1990) Absorptive capacity: a new persepctive on learning and innovation. *Administrative Science Quarterly 35* (1): 128-152.

Cooke P (1998) Introduction: origins of the concept. In Braczyk H J, Cooke P, Heidenreich M (eds) *Regional Innovation Systems. The Role of Governances in a Globalized World.* UCL Press, London.

Cooke P, Boekholt P, Todtling F (2000) *The Governance of Innovation in Europe: Regional Perspectives on Global Competitiveness.* Pinter: London.

Cooke P, Morgan K (1998) *The Associational Economy: Firms, Regions and Innovation.* Oxford University Press, Oxford.

Coombs R, Harvey M (2001) Analysing Distributed Innovation Processes. *CRIC Paper Series May No 43.* University of Manchester.

Coombs R, Richards A, Savioti P, Walsh V (1996) *Techological Collaboration: The Dynamics of Co-operation in Industrial Innovation.* Edward Elgar, Cheltenham.

Crevoisier O, Camagni R (2000) *Les Milieux Urbains: Innovation, Systemes de Production et Ancrage.* EDES, Neuchatel.

Criscuolo C, Haskel J (2003) Innovation and productivity growth in the UK: evidence from CIS2 and CIS3. *Working Paper.* Centre for Research into Business Activity.

Delmestri G (1997) Convergent organizational responses to globalisation in the Italian and German machine-building industries. *International Studies of Management and Organisation, 27* (3): 86-108.

Dhont-Peltrault E (2005) *Les relations interentreprises en R&D, Note d'Information.* DEPP-MESR, Paris.

Dodgson M, Rothwell R. (1991) Technology strategies in small firms. *Journal of General Management 17* (1): 45-55.

Dougherty D, Hardy C (1996) Sustained product innovation in large, mature organizations: overcoming innovation-to-organization problems. *Academy of Management Journal 39*: 1120-1153.

Drazin R, Schoonhoven CB (1996) Community population, and organization effects on innovation: a multilevel perspective. *Academy of Management Journal 39* (5): 1065-1083.

Edwards T, Delbridge R, Munday M (2005) Understanding innovation in small and medium-sized enterprises: a process manifest. *Technovation 25*: 1119-1127.

Faems D, Van Looy B, Debackere K (2005) Interorganizational collaboration and innovation: towards a portfolio approach. *Journal of Product Innovation Management 22* (3): 238-250.

Filippi M, Torre A (2003) Local organisations and institutions. How can geographical proximity be activated by collective projects? *International Journal of Technology Management 26* (2-4): 368-400.

Florida R (1995) Towards the learning region. *Futures 27* (5): 527-536.

Fritsch M, Lukas R (1997) Innovation, cooperation, and the region. *Conference On The Impact Technological Change on Firm and Industry Performance.* Tinbergen Institute, Rotterdam.

Fritsch M, Lukas R (2001) Who cooperates on R&D? *Research Policy 30* (2): 297-312.

Gavetti G, Levinthal D (2000) looking forward and looking backward: cognitive and experiential search. *Administrative Science Quarterly, 45*: 113-137.

Hagedoorn J, Schakenraad J (1992) Leading companies and networks of strategic alliances in information technologies. *Research Policy 21* (2): 163-190.

Hakansson H (1989) *Coporate Technological Behaviour: Co-operation and Networks.* Routledge, London.

Helfat C E (2000) Guest editor's introduction to the special issue: the evolution of firm's capabilities. *Strategic Management Journal 21*: 955-961.

Herstad S, Bloch C, Ebersberger B, de Veld E V (2008) *Open innovation and globalisation: theory, evidence and implications.* VISION ERA.NET, Brussels.

Hutton W (1995) *The State Were In.* Jonathan Cape, London.

Johannisson B, Monsted M (1997) Contextualizing entrepreneurial networking. *International Studies of Management and Organisation 27* (3): 109-137.

Jones O Tilley F (2003) *Competitive Advantage in SMEs: Organizing for Innovation and Change.* Wiley, Chichester.

Kaufmann A, Todtling F (2002) How effective is innovation support for SMEs? An analysis of the region of Upper Austria. *Technovation 22*: 147-159.

Kaufmann A, Todtling F (2000) Systems of innovation in traditional industrial regions: the case of Styria in a comparative perspective. *Regional Studies 34* (1): 29-40.

Kim L (1998) Crisis construction and organizational learning: capacity building in catching-up at Hyundai Motor. *Organization Science 9* (4): 506-521.

Kim L (1997) The dynamics of Samsung's technological learning in semiconductors. *California Management Review 39* (3): 86-100.

Kim L (2001) The dynamics of technological learning in industrialization. *International Social Science Journal 53* (168): 297-308.

Lane P J, Lubatkin M L (1998) Relative absorptive capacity and interorganizational learning. *Strategic Management Journal 19* (5): 461-477.

Lane P J, Slak J E, Lyles M A (2001) Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal 22* (10): 1139-1161.

Langlois R N, Steinmuller W E (2000) Strategy and circumstances: the response of American firms to Japanese competition in semiconductors, 1980-1995. *Strategic Management Journal 21*: 1163-1173.

Laursen K, Salter A (2004) Searching high and low: what types of firms use universities as a source of innovation? *Research Policy 33* (8): 1201-1215.

Laursen K Salter A (2006) Open innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal 27* (2): 131-150.

Leonard-Barton D (1992) Core-capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal 13*: 111-125.

Loof H, Heshmati A (2002) Knowledge capital and performance: a new firm level innovation study. *International Journal of Production Economics 76* (1): 61-85.

Maillat D, Kebir L (1999) Learning region et systemes territoriaux de production. *Revue d'Economie Regionale et Urbaine 3*: 430-448.

Masurel E and Werkhoven F (2006) *Pieken en Dalen in de Delta.* Vrije Universiteit Amsterdam, Amsterdam.

Ministry of Economic Affairs (2004) *Peaks in the Delta; Regional Economic Perspectives.* Directorate Spatial and Regional Economic Policy. Ministry of Economic Affairs, The Hague.

Miotti L, Sachwald F (2003) Co-operative R&D: why, and with whom? An integrated framework of analysis. *Research Policy 32* (8) 1481-1499.

Morgan K (1997) The learning region: institutions, innovation and regional renewal. *Regional Studies 31* (5): 491-504.

Mowery D C, Oxley J, Silverman B (1996) Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal 17* (1): 77-91.

Newell S, Robertson M, Scarbrough H, Swan J (2002) *Managing Knowledge Work.* Hampshire: Palgrave.

Nieto M J, Santamaria L (2007) The importance of diverse collaborative networks for the novelty of product innovation. *Technovation 27* (3): 367-377.

Nonaka I (1994) A dynamic theory of organizational knowledge creation. *Organization Science 5* 14-37.

Nonaka I (1991) The knowledge-creating company. *Harvard Business Review November-December*: 96-104.

Oakey R, Cooper S (1991) the relationship between product technology and innovation performance in high technology small firms. *Technovation 11* (2): 79-91.

OECD (2009) *The role of community research policy in the knowledge-based economy: expert group report.* Directorate-General for Research, Brussels.

Powell W, Koput K, Smith-Doerr L (1996) Interorganizational collaborationand the locus of innovation: networks of learning in the biotechnology. *Administrative Science Quarterly 41* (1): 116-145.

Preti P (1991) *L'organizzazione della piccola impresa [The Organization of SMEs).* Egea, Milan.

Pyke P, Becattini G, Sengenberger W (1990) *Industrial Districts and Inter-Firm Co-operation in Italy*. ILO: Geneva.

Radosevic S (1990) The role of small firms in technological development: an interpretative study. *International Journal of Technology Management 5* (1): 89-99.

Rallet A, Torre A (1998) On geography and technology: proximity relations in localised in innovation networks. In Steiner M (ed) *From Agglomeration Economies to Innovative Clusters.* Pion, European Research in Regional Science, London.

Riedle K (1989) Deman for R&D activities and trade-off between in-house and external research: a viewpoint from industry with refernce to large companies and small and medium-sized enterprises. *Technovation 9*: 213-225.

Rinholm B, Boag D (1987) Controlling new product development in the small technology-based firm. *American Journal of Small Business 12* (1): 12-19.

Scarbrough H (1995) Blackboxes, hostages and prisoners. *Organization Studies 16* (6): 991-1019.

Smallbone D, North D, Vickers I (2000) The role and character of SMEs. In Isaksen A, Asheim B T, Nauwelaers C, North D Todtling F (eds) *SME Policy and the Regional Dimension of Innovation. Final report of the TSER-research project SMEPOL.* Oslo.

Soeters J (1993) Managing Euro-regional networks. *Organization Studies 14*: 639-656.

Sternberg R (1998) Innovierende Industrieunternehmen und ihre Einbindung in intraregionale versus interregionale Netzwerke. *Raumforschung und Raumordnung 4* (56): 288-298.

Stock G N, Greis N P, Fisher W A (2001) Absorptive capacity and new product development. *Journal of High Technology Management Research 12* (1): 77-91.

Tether B (2002) Who co-operates for innovation, and why: an emperical analysis. *Research Policy 31* (6): 947-967.

Todorova G, Durisin B, (2007) Absorptive capacity: valuing a reconceptualization. *Academy of Management Review 32* (3): 774-786.

Torre A (2008) On the role played by temporary geographical proximity in knowledge transmission. *Regional Studies 42* (6): 869-889.

Torre A, Gallaud D (2004) Geographical proximity and circulation of knowledge through inter-firm cooperation. In Wink R (ed) *Academia-Business Links.* Palgrave, Macmillan, London.

Torre A, Rallet A (2005) Proximity and localization. *Regional Studies 39* (1): 47-60.

Tripsas M, Gavetti G (2000) Capabilities, cognition and inertia: evidence from digital imagining. *Strategic Management Journal 21*: 1147-1162.

Tsai K.-H (2009) Collaborative networks and product innovation performance: toward a contingency perspective. *Research Policy 38*: 765-778.

Uzzi B (1997) Social structure and competition in inter-firm networks: the paradox of embeddedness. *Administrative Science Quarterly 42*: 35-67.

Van Geenhuizen M, Nijkamp P (2006) Learning regions in an evolutionary context: policymaking for high technology firms. *International Journal of Entrepreneurship and Innovation Management 6* (3): 265-282.

Von Hippel E (1988) *The Sources of Innovation.* Oxford University Press, Oxford.

Whitley R (2003) The instituional structuring of organizational capabilities: the role authority sharing and organizational careers. *Organization Studies 24* (5): 667-696.

Zahra S A, George G (2002) Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review 27* (2): 185-203.

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